Oceanography: Water, Wind, & Weather

Stage 1 Desired Results

ESTABLISHED GOALS:

Competencies:

- **Energy & Matter in Systems** Students will demonstrate the ability to analyze evidence from a variety of sources (investigations, models) to predict, connect and/or evaluate the cycling of matter and flow of energy within and between systems in order to understand, describe, or predict possibilities and limitations of systems.
- **Structure & Function** Students will demonstrate the ability to use evidence to support claims about the relationship among structure and function of natural and human designed objects.
- **Stability & Change in Systems** Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time.
- **Nature of Science** Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in a various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions.
- ***Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials.***
- ***Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences.***
- ***Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style.***

Content Standards:

- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.• HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the

Transfer

*Students will be able to independently use their learning to **make informed decisions and act responsibly based upon their knowledge of an ocean system.***

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- the total amount of energy and matter inclosed systems is conserved.
- energy drives the cycling of matter within and between systems.
- the functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.
- much of science deals with constructing explanations of how things change and how they remain stable.
- feedback (negative or positive) can stabilize or destabilize a system.

ESSENTIAL QUESTIONS

- *Does the ocean influence weather or does the weather influence the ocean?*

Acquisition

Students will know…

- that Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
- that evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational

Students will be skilled at…

- analyzing data to make claims.
- developing models.
- planning and conducting investigations.
- developing a quantitative model.
- constructing an argument based on evidence.

hydrosphere, atmosphere, geosphere, and biosphere. ● HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	movement of denser materials toward the interior. ● that the radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. ● that the abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. ● that the foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. ● that gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ● that changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. ● that the many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. ● that Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. ● that Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. ● that plate tectonics is the unifying theory that explains the past and current movements of	

	the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. ● that, although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. ● that plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. <u>*vocabulary*</u>: specific heat of water, specific gravity of water, density, freshwater, salt water, wind, pressure, Coriolis effect, Newton's laws, centripetal force, neap tides, spring tides, proximal tides, storm surges, sedimentary layers (marine snow), upwelling, sea ice, artic, food chain	
Content Area Literacy Standards		***21st Century Skills***
• RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*. • RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. • RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. • WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.		• *use systems thinking* • *solve problems* • *work creatively with others* • *communicate clearly*

• WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. • WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. • WHST.11-12.1 Write arguments focused on *discipline-specific content*. • WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.	

Stage 2 - Evidence

Evaluative Criteria	*Assessment Evidence*
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

Subunits:
Water (why is it special)
Tides and Currents
Ocean/ Climate

Language Arts Integration	*Mathematics Integration*
• 1.OA.1 Use	**HSN-Q.A.1** - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data

	displays. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-6) **HSN-Q.A.2** - Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-3), (HS-ESS2-6) **HSN-Q.A.3** - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-5), (HS-ESS2-6) **MP.2** - Reason abstractly and quantitatively. (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-6) **MP.4** - Model with mathematics. (HS-ESS2-3), (HS-ESS2-6)
Technology Integration	***District Materials***
• 1.OA.1 Use	
Science and Engineering Practices	
S&EP 1. Asking questions and defining problems S&EP 2. Developing and using models S&EP 3. Planning and carrying out investigations S&EP 4. Analyzing and interpreting data S&EP 6. Constructing explanations (for science) and designing solutions (for engineering) S&EP 7. Engaging in argument from evidence S&EP 8. Obtaining, evaluating, and communicating information	